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Abstract *Purpose* Research suggests the importance of psychosocial factors in recovery from musculoskeletal injuries. The objective of this study was to identify predictors of recovery among U.S. Marines who had musculoskeletal injuries of the back, knee, or shoulder. *Methods* A sample of 134 participants was assessed at baseline and followed for 1 year to determine outcome information. *Results* The strongest predictor of injury recovery at the 1-year follow-up was recovery expectations. In a multivariate logistic model with key demographic and psychosocial factors controlled, individuals who had high recovery expectations at baseline were over five times as likely to be recovered at follow-up as individuals who had low expectations (OR = 5.18, $p < .01$). *Conclusions* This finding is consistent with a large body of research that has linked recovery expectations with better recovery outcomes in patients with musculoskeletal injuries as well as with research linking recovery expectations with better outcomes across a wide range of medical conditions. Applied to military populations, interventions designed to modify recovery expectations may have the potential to improve rates of return to duty and to reduce rates of disability discharge.

Keywords Injury · Musculoskeletal injury · Psychosocial factors · Recovery · Recovery expectations · Military

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Background

Musculoskeletal injuries are a common cause of work-related absences and disability in civilian and military populations. Despite the relative youth of military populations, these injuries are a substantial problem for the U.S. military. Musculoskeletal injuries and orthopedic conditions (e.g., of the knee and back) are now the most common reason for disability discharges in all branches of the military, and they account for a large proportion of military hospitalizations [1, 2].

Research suggests that traditional biomedical variables (e.g., type of injury, severity) are not the only factors that play a role in musculoskeletal injury recovery and return to work. Researchers and medical professionals are beginning to recognize that injury recovery and the processes leading to return to work are best conceptualized as influenced by a wide range of factors [3–5]. Growing evidence supports the importance of psychosocial factors in the injury recovery process.

The literature provides evidence for psychosocial factors that may predict recovery from musculoskeletal injuries.

The psychosocial factor that has been the most consistently associated with better recovery outcomes is recovery expectations. Past studies suggest that individuals who have high expectations about their own recovery have better outcomes than those with lower expectations. This has been found in a substantial number of civilian studies involving return to work, duration of disability, cost of lost time, and pain [4, 6–8]. In addition, two military studies found evidence supporting the importance of recovery expectations among service members with musculoskeletal injuries [9, 10].

It has been increasingly recognized that cognitive factors have an important impact on recovery from musculoskeletal injuries. One factor that appears promising as a predictor of injury recovery is fear-avoidance beliefs. Fear-avoidance beliefs are a patient's beliefs that physical or work-related activities will make the injury or the pain worse. A substantial number of studies have found that a high level of fear-avoidance beliefs is predictive of poorer recovery outcomes in patients with back pain [11–14]. Another cognitive factor that may play a role in injury recovery is pain catastrophizing. Pain catastrophizing involves an exaggerated negative orientation toward painful or noxious stimuli [15]. Although less studied than fear avoidance, there is some evidence that pain catastrophizing may have a negative impact on injury outcomes [16, 17]. In this study we examined fear-avoidance beliefs and pain catastrophizing.

A number of studies have linked depression and psychological distress with poorer recovery and return-to-work outcomes [3, 18, 19]. Lanier and Stockton [19] found that a history of depression or anxiety was a significant predictor of more days lost from work. Similarly, Schultz et al. [8] identified better mental health as a predictor of return to work among individuals with back injuries. Depression has also been identified as a key risk factor associated with patients' transition from acute to chronic back pain status [3]. Literature reviews of psychosocial factors associated with recovery from back pain have identified depression or psychological distress as an important prognostic factor [5, 18]. In the present study, we examine depression in relation to injury recovery.

Another psychological characteristic that may play a role in injury recovery is dispositional optimism. Dispositional optimism is a global personality characteristic reflecting an individual's general outlook on life. Optimism has been associated with pain and recovery outcomes [20, 21]. One study found a predictive association between dispositional optimism and better recovery after knee surgery [21]. Other research has found a positive association between optimism and recovery from heart surgery [20, 22]. At a general level, optimism appears to have a wide range of positive effects on physical health [23, 24]. In the present study, optimism was examined as a predictor of injury recovery.

Research has found that a number of psychosocial workplace factors, such as supervisor support and job satisfaction, are associated with injury recovery and return-to-work outcomes. In general, positive workplace factors have been prospectively linked with better recovery outcomes [25, 26]. Low supervisor support has been associated with lower rates of return to work and greater work disability among back pain patients [27]. Overall workplace support (coworker support and supervisor support) has also been associated with better return-to-work outcomes in individuals with musculoskeletal injuries and orthopedic conditions [26, 28]. In addition, job satisfaction has been found to be predictive of injury recovery outcomes [29, 30] and return-to-work status after back surgery [31]. We examined supervisor support and job satisfaction as predictors of injury recovery.

Although a large number of studies have investigated psychosocial predictors of injury recovery, the most promising predictors of recovery have not been simultaneously examined within the same study. Based on past research, the most important predictors of injury recovery consist of recovery expectations, fear-avoidance beliefs, and depression. The goal of the present study was to examine all of these psychosocial variables within the same study design, so that their relative importance could be determined. Some additional predictors that appeared promising (e.g., optimism, pain-catastrophizing, supervisor support, and job satisfaction) were also included. These potential predictors of recovery from musculoskeletal injuries were examined in a sample of U.S. Marine Corps personnel with musculoskeletal injuries (back, knee, or shoulder) who were followed prospectively for 1 year.

Method

Overview

This study consisted of a baseline data collection and a 1-year follow-up data collection. A sample of 222 Marines who had musculoskeletal injuries (back, knee, or shoulder) participated in the baseline phase of the study; these participants were interviewed and completed a survey that asked about their injury and other factors. One year later, we attempted to recontact all of the original study participants (N = 222) to administer a follow-up interview/survey to determine the degree to which participants had recovered from their injuries. A total of 134 of the original baseline sample completed the follow-up phase of the study (60 % response rate). Results are presented for this sample of 134 Marines who had both baseline and follow-up data.

Participants

The original sample of study participants consisted of 222 active-duty enlisted U.S. Marines seeking treatment for a musculoskeletal injury in a military sports medicine or military physical therapy clinic. To be eligible for the study, participants had to have a musculoskeletal injury of the back, knee, or shoulder. Participant who had multiple injuries (e.g., injuries to more than one anatomical region of the body) were excluded. Participants with fractures, tumors, and serious medical conditions other than musculoskeletal injuries were excluded. Participants were excluded if they were scheduled to separate from the military within 1 year.

Baseline Measures

Pain Severity The pain severity scale of the Brief Pain Inventory (BPI), Short Form [32] was used to assess participants' pain severity. The BPI pain severity scale consists of four pain items, which are answered on a 10-point scale, ranging from 0 (*no pain*) to 10 (*pain as bad as you can imagine*). The four items ask respondents to rate their average pain, their worst pain, their least pain, and their pain "right now." After summing BPI items to form the pain severity scale, pain severity scores were classified into three groups (low, medium, high) based on the tertile distribution of the scores.

Depression The Center for Epidemiologic Studies Depression Scale (CES-D) was used to measure depression [33]. The CES-D is a 20-item measure that has been used extensively in past research. Respondents rate each item using a 4-point scale, ranging from 0 (*rarely or none of the time*) to 3 (*most or all of the time*). Adequate psychometric properties have been found for this measure [33, 34].

Recovery Expectations A single item was used to assess participants' expectations about their injury recovery. It was: "I strongly believe that I will recover quickly from my injury." This measure was used in a previous study of injury recovery in the military [9]. The item was presented with a 5-point scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Recovery expectations scores were classified into three groups (low, medium, high) based on the tertile distribution of the item responses.

Pain Catastrophizing The Pain Catastrophizing Scale (PCS) was used to assess catastrophizing responses to pain and injury. The PCS is a 13-item scale developed by Sullivan et al. [15]. Each item is rated on a 5-point scale, ranging from 0 (*not at all*) to 4 (*all the time*). Sample items include "I become afraid that the pain may get worse" and "I feel I can't go on." The PCS has been found to have adequate psychometric properties [15, 35], high internal consistency ($\alpha = .92$; [35]), and adequate test–retest reliability ($r = .75$ across a 6-week period [15]).

Fear Avoidance The Fear-Avoidance Beliefs about Work subscale (FABQ-Work) of the Fear-Avoidance Beliefs Questionnaire [36] was used to measure participants' work-related fears and beliefs about their injuries. Each item on the FABQ-Work measure is answered on a 7-point scale, ranging from 0 (*completely disagree*) to 6 (*completely agree*). Sample items include "My work aggravated my pain" and "My work makes or would make my pain worse."

Optimism Optimism was assessed using the Life Orientation Test-Revised (LOT-R), a widely used measure of dispositional optimism [37]. The LOT-R consists of 10 items, of which 4 are filler items. Each item is rated on a 5-point scale, ranging from 0 (*strongly disagree*) to 4 (*strongly agree*).

Job Satisfaction Job satisfaction was measured using a 5-item scale [38], which was adapted from an 18-item job satisfaction scale [39]. Items are rated on a 7-point scale, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Sample items include "I find real enjoyment in my work" and "Each day of work seems like it will never end."

Supervisor Support Perceived supervisor support was measured using the Perceived Supervisor Support Scale [40]. This 8-item scale was adapted from the short form of the Survey of Perceived Organizational Support [41]. Each item is rated on a 7-point scale, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Sample items include "Help is available from my supervisor when I have a problem" and "My supervisor cares about my opinions."

Physical Workload of Job A single item assessed the physical workload of respondents' jobs. The item was: "Please rate your job's physical workload (degree of heavy lifting and physical exertion)." This item was rated on a 5-point scale, ranging from 1 (*very light*) to 5 (*very heavy*).

Injury Information During the interview, respondents were asked what type of injury they had (e.g., back, shoulder, or knee), how the injury occurred, and how long they had had the injury.

Body Mass Index Respondents were asked to report their height and weight; this information was used to compute body mass index (BMI = weight in pounds/(height in inches $\times$ height in inches) $\times$ 703).

Demographic and Military Background Information The questionnaire asked for the following demographic and military information: gender, age, ethnic background, education level, marital status, rank/paygrade, military occupation, and tenure in the military.

Procedures

Baseline Data Collection

We invited Marines with musculoskeletal injuries attending military sports medicine or physical therapy clinics to participate in the study. Participation was voluntary and military leaders were not present during study enrollment or data collection. All study procedures were approved by the Naval Health Research Center Institutional Review Board. The potential participants were approached in a military clinic setting while they were waiting for their appointments. The overall response rate was 64 %. Reasons for failing to participate were not collected from participants who did not volunteer for the study at baseline. It appeared to the researchers that the most common reason for nonparticipation was a lack of time, since most participants were expected to return to their duty stations at the end of their medical appointment.

After providing informed consent, Marine participants were administered a survey and a brief interview. During the baseline data collection session, each participant was asked for permission to be recontacted by the research team 1 year later for a follow-up survey. Participants were told that purpose of the follow-up survey would be to obtain information on their injury status and degree of recovery. After participants agreed to the follow-up assessment, they completed a personal information sheet on which they provided their contact information (phone numbers, e-mail addresses, and mailing address).

Follow-up Data Collection

A year after baseline data collection, attempts were initiated to recontact all of the original (baseline) study participants (N = 222). Participants were contacted by telephone, e-mail, or both. They were invited to participate in a brief follow-up survey, which consisted of a telephone interview or an Internet survey with the same questions. Participants who completed the follow-up assessment were mailed a $5.00 fast-food gift card.

134 of the original 222 baseline participants completed the follow-up survey (60 % response rate for the follow-up). Of these 134 participants, 90 completed the telephone interview and 44 completed the equivalent Internet survey. Although we do not have specific data on the reasons that baseline participants did not participate in the follow-up telephone interview or the equivalent Internet survey, it is likely that a portion of this nonresponse was due to deployments, extended travel, extended training assignments, and changes of duty station on the part of our military sample.

At the start of the follow-up interview, each participant was reminded of the type of injury that he or she had reported on at baseline (e.g., knee, back or shoulder). Participants were informed: "The questions in this interview ask about your original injury. This means the specific injury or pain problem that you had at the time you were interviewed for the Injury Recovery Study about one year ago." This was done to ensure that participants' responses focused on the original injury, since some participants may have experienced other injuries during the time interval between the baseline and the follow-up interviews.

In the follow-up interview, participants' self-rated recovery and pain levels were assessed. Self-rated recovery was assessed using this question: "On a scale ranging from 0 to 10, with 0 meaning 'not at all recovered' and 10 meaning 'completely recovered,' please rate the degree to which you consider yourself to be recovered from your injury right now." Pain was assessed using this question: "Using a 0–10 scale, with 0 meaning 'no pain' and 10 meaning 'pain as bad as you can imagine,' what number indicates how much pain you felt from this injury on average during the past week?"

The two outcome scores (recovery and pain) were converted into standard scores (z-scores) and summed to form a single composite score representing the participants' overall recovery, after the directionality of the component scores were aligned. Thus, the composite score we used to reflect injury recovery was made up of ratings of both self-assessed recovery and self-rated pain (equally weighted). A very high correlation was found between self-assessed recovery ratings and pain ratings: $r = .92$ ($p < .01$), which provided ample justification for the composite approach.

Data Analysis

Descriptive analyses were performed to determine the demographic characteristics of the study participants. Pearson correlations were computed to determine the strength of association among the study variables. Correlations of the demographic and psychosocial variables were computed in relation to (1) self-rated recovery, (2) self-rated pain, and (3) the composite score representing overall recovery.

Univariate and multivariate logistic regression were used to determine the effects of the demographic and psychosocial predictors on injury recovery. For the logistic regression analyses, the composite scores representing

overall recovery were divided into tertiles (low, medium, high). The participants in the top one third of the distribution (the top tertile) were considered to be "recovered," and those in the bottom two thirds of the distribution were considered to be "not recovered." An inspection of the raw data for participants classified as recovered (top tertile) confirmed that, as would be expected, their raw recovery scores were high and their pain scores were low. In the logistic regression, participants in the top tertile were compared with those in the bottom two tertiles.

We performed a series of univariate logistic regression to determine the odds ratios (ORs) and 95 % confidence intervals for each variable of interest. All of the variables that were significant in the univariate logistic regression with overall recovery at the $p \leq .10$ significance level, along with four other covariates (gender, age, education, and anatomical site of injury), were entered as candidates into a multivariate logistic regression model. For the final multivariate model, a stepwise method was used with an inclusion value of $p < .05$ and a removal value of $p > .10$. Regression diagnostics were performed in which tolerance and variance inflation factors were evaluated. These did not reveal any substantial collinearity among the variables. Statistical analyses were performed using SPSS for Windows, software, version 18 (SPSS Inc., Chicago, IL).

Results

Of the original 222 baseline participants, 134 completed the follow-up survey (60 % response rate). Responders and nonresponders were compared to determine if there were any differences between those who completed the follow-up survey and those who did not. There were no significant differences between responders and nonresponders, according to site of injury (back, knee, or shoulder), age, ethnicity, education level, marital status, or military paygrade. There was a difference for gender: female participants were more likely than male participants to have completed the follow-up survey ($\chi^2 = 4.30$; $p < .05$; results not shown).

The study participants were active-duty enlisted U.S. Marines. The sample was mostly male (87.3 %; Table 1). The primary ethnic groups were white (70.1 %), black (13.4 %), and Hispanic (10.4 %). About half of the participants had a high school diploma or less (47.8 %); the rest had some college or a college degree (52.2 %). Approximately two thirds of the sample were married (64.2 %). The average age was 25.5 years (SD = 6.1). The most common injuries in the participants were knee injuries (50.7 %), followed by back injuries (32.8 %), and shoulder injuries (16.4 %).

Pearson correlations between the key variables in the study are shown in Table 2. Although most of the study variables were not highly correlated with each other, moderate correlations were found between these pairs: fear avoidance about work and physical workload of job ($r = .55$, $p < .01$), depression and pain catastrophizing ($r = .52$, $p < .01$), pain severity and pain catastrophizing ($r = .49$, $p < .01$), and job satisfaction and supervisor support ($r = .46$, $p < .01$). Recovery expectations correlated significantly with the following: pain catastrophizing ($r = -.41$, $p < .01$), fear avoidance about work ($r = -.30$, $p < .01$), and pain severity ($r = -.27$, $p < .01$).

Correlation coefficients of the predictor variables in relation to the pain and recovery outcomes are shown in Table 3. Four variables were significantly correlated with the overall recovery composite score: pain severity ($r = -.45$, $p < .01$), recovery expectations ($r = .40$, $p < .01$), pain catastrophizing ($r = -.35$, $p < .01$), and fear-avoidance beliefs about work ($r = -.19$, $p < .05$). Recall that the composite score reflecting overall recovery was made up of ratings of both self-assessed recovery and self-rated pain (equally weighted and summed). The correlation

Table 1 Characteristics of study participants (N = 134)

Characteristic	n	%
Gender		
Men	117	87.3
Women	17	12.7
Age, years		
18–21	38	28.4
22–25	53	39.6
≥26	43	32.1
Education		
High school or less	64	47.8
Some college or college degree	70	52.2
Race/ethnicity		
White, non-Hispanic	94	70.1
Black, non-Hispanic	18	13.4
Hispanic	14	10.4
Other	8	6.0
Marital status		
Never married	35	26.1
Married	86	64.2
Divorced	13	9.7
Tenure in the military		
<2 years	25	18.7
2–4 years	54	40.3
≥4 years	55	41.0
Anatomical site of injury		
Shoulder	22	16.4
Knee	68	50.7
Back	44	32.8

Due to rounding, some percentages may not sum to 100

Table 2 Pearson correlations between Time 1 study variables

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Recovery expectations	–												
2. Pain severity	−.27**	–											
3. Pain catastrophizing	−.41**	.49**	–										
4. Fear avoidance—work	−.30**	.33**	.20*	–									
5. Depression	−.15	.27**	.52**	.27**	–								
6. Optimism	.07	−.04	−.23**	−.10	−.53**	–							
7. Job satisfaction	.12	.07	−.09	−.19	−.25**	.32**	–						
8. Supervisor support	.13	−.05	−.12	−.14	−.23**	.26**	.46**	–					
9. Time since first injured	−.08	.01	.09	−.14	−.13	.05	.00	.05	–				
10. Physical workload of job	−.05	.23**	.10	.55**	.15	−.04	−.09	−.10	−.07	–			
11. Age	−.01	−.18*	−.15	−.24**	−.29**	.22*	.34**	.28**	.32**	.34**	–		
12. Education	−.12	.06	.02	−.06	.01	.05	.07	−.01	.00	−.09	.25**	–	
13. Body mass index	.01	−.04	−.11	−.02	−.35**	.09	.02	.03	−.06	−.07	.13	−.08	–

* $p < 0.05$; ** $p < 0.01$

Table 3 Correlations of Time 1 demographic and psychosocial variables with pain and recovery outcomes at the 1-year follow-up

Time 1 variable	Self-reported recovery (0–10) at follow-up	Pain rating (0–10) at follow-up	Overall recovery (composite) at follow-up
Recovery expectations	.42**	−.32**	.40**
Pain severity	−.35**	.47**	−.45**
Pain catastrophizing	−.28**	.36**	−.35**
Fear avoidance—work	−.18*	.16	−.19*
Depression	−.04	.17	−.11
Optimism	.02	−.07	.05
Job satisfaction	−.07	−.10	.02
Supervisor support	.08	−.12	.11
Time since first injured	−.11	.14	−.14
Physical workload of job	.01	.11	−.06
Age	−.06	−.06	.00
Education	.00	−.04	.02
Body mass index	−.09	.01	−.05

* $p < 0.05$; ** $p < 0.01$

between the self-assessed recovery and pain ratings was $r = .92$ ($p < .01$).

Logistic regression analysis identified predictors of the injury recovery composite at the 1-year follow-up. In the univariate logistic regression analysis (results not shown), four of the baseline variables were significantly associated with the overall recovery outcome: recovery expectations ($p < .01$), pain severity ($p < .01$), fear-avoidance beliefs about work ($p < .05$), and anatomical site of the injury ($p < .05$). Also, pain catastrophizing had a marginally significant association with recovery in the univariate regression ($p = .051$).

In the final multivariate logistic regression model (adjusting for gender, age, education, and anatomical site of injury), two baseline psychosocial variables were predictive of the injury recovery composite at follow-up: recovery expectations and pain severity (Table 4). Participants in the highest tertile of recovery expectations were over five times as likely to be recovered 1 year later as those in the lowest tertile of expectations (OR = 5.18, $p < .01$). Participants who reported greater pain severity at baseline were less than one third as likely to be considered recovered at follow-up as those who reported low pain severity at baseline (OR = 0.27, $p < .05$, comparing lowest and highest tertiles). Anatomical site of the injury also remained a significant predictor of recovery in the multivariate model; participants with back injuries were less likely to be recovered a year later than those with shoulder or knee injuries (OR = 0.23, $p < .05$).

Discussion

The objective of this study was to identify psychosocial determinants of injury recovery among military members

Table 4 Final multivariate logistic regression model to predict injury recovery at 1-year follow-up

Variable	OR	95 % CI
Gender		
Men (reference)	1.00	
Women	0.80	0.21–2.96
Age, years		
18–21 (reference)	1.00	
22–25	1.27	0.45–3.58
≥26	0.51	0.17–1.59
Education		
High school or less (reference)	1.00	
Some college or college degree	1.39	0.58–3.31
Anatomical site of injury		
Shoulder (reference)	1.00	
Knee	0.69	0.21–2.24
Back	0.23*	0.06–0.89
Recovery expectations		
Low (reference)	1.00	
Medium	1.34	0.44–4.06
High	5.18**	1.92–13.98
BPI pain severity score		
Low (reference)	1.00	
Medium	0.55	0.20–1.52
High	0.27*	0.09–0.76

The following were entered (forced in) as covariates: gender, age, education, and site of injury

BPI Brief Pain Inventory, *CI* confidence interval, *OR*, odds ratio

* $p < 0.05$; ** $p < 0.01$

who sought treatment for musculoskeletal injuries. An important goal of the study was to examine the most important predictors of injury recovery (recovery expectations, fear-avoidance beliefs, and depression) within the same study, so that their relative importance could be evaluated. We also examined some additional predictors that appeared promising based on past research (optimism, pain-catastrophizing, supervisor support, and job satisfaction).

In a sample of U.S. Marines with back, knee, or shoulder injuries who were followed prospectively for 1 year, a number of factors were predictive of injury recovery. At the univariate level, we found that the following psychosocial factors predicted injury recovery: recovery expectations, pain severity, and fear-avoidance beliefs about work. In the multivariate logistic model, only two psychosocial variables predicted injury recovery: recovery expectations and pain severity.

The strongest predictor of injury recovery at the 1 year follow-up was recovery expectations. With other key demographic and psychosocial factors controlled, individuals who had high recovery expectations at baseline were over five times as likely to be considered recovered at follow-up as individuals who had low expectations. This finding is consistent with a large body of research that found significant associations between recovery expectations and better outcomes in patients with musculoskeletal injuries [4, 6–9]. Moreover, recovery expectations have been linked with better outcomes and functional status across a broad range of conditions [42], including laparoscopic surgery [43], myocardial infarction [44], coronary heart disease [45], whiplash [46], total joint arthroplasty [47], and psychiatric disorders [48].

The finding of a strong predictive association between expectations and injury recovery and the consistency of our results with previous findings point to the importance of this construct from both scientific and clinical perspectives. Currently, we lack an adequate understanding of the construct of recovery expectations and its role in injury recovery. In the present study, recovery expectations overlapped with both pain catastrophizing and fear-avoidance beliefs, but recovery expectations were much more powerful than either of these other cognitive factors in predicting recovery.

Researchers have suggested a number of possible mechanisms for an influence of recovery expectations on musculoskeletal pain conditions or recovery outcomes [49, 50]. First, positive expectations may promote a physiological response that directly reduces pain (e.g., expectation-related analgesia) [51]. Second, positive expectations may lead to increased motivation on the part of the patient to adhere to treatment and greater likelihood of participation in rehabilitation [49]. Third, patients with positive expectations may use more effective coping strategies (e.g., more problem-focused coping and less emotion-focused coping), which may lead to greater treatment adherence and better clinical outcomes. Finally, positive expectations about recovery may reduce patients' distress and negative emotions about their musculoskeletal pain condition, which may, in turn, result in lower pain levels and improved recovery.

Rather than being a trait characteristic, recovery expectations appear to be a process that is potentially modifiable. For example, research with cardiac patients [52] tested a brief intervention to alter patients' perceptions and beliefs about their condition. These researchers showed that patients who received the intervention had better functional outcomes than those who did not. Another study of cardiac patients [53] demonstrated that a brief intervention designed to target patients' beliefs about their illness resulted in better recovery outcomes.

Our findings suggest that it may be productive to test brief interventions specifically designed to modify musculoskeletal injury patients' expectations about recovery and their ability to return to work, using a randomized controlled study design. Applied to military populations,

these interventions may have the potential to improve rates of return to duty and to reduce rates of disability discharge.

The fact that pain severity was a predictor of poorer outcomes in the present study is not surprising. Numerous studies have confirmed that pain severity is a predictor of less favorable recovery outcomes [26, 29, 54]. Individuals who report greater pain severity likely have more severe or more complicated injuries that are less likely to respond to treatment than those who report less pain severity [55].

Although fear-avoidance beliefs about work were predictive of recovery in the univariate analysis, this result did not persist in the final multivariate model. In this respect, our findings were inconsistent with a number of other studies, including some prospective studies that have shown the importance of fear-avoidance beliefs in relation to recovery outcomes [11–14]. One possible reason for our null finding for fear-avoidance beliefs (in the multivariate model) is that recovery expectations may include thoughts that are also part of fear-avoidance beliefs. This seems plausible, given that the vast majority of studies examining fear-avoidance beliefs have not simultaneously included recovery expectations as a predictor (see research by Turner et al. [14] for an exception). It may be that recovery expectations overlap conceptually with fear-avoidance beliefs, but have a more powerful impact on recovery. Alternatively, it is possible that our study simply lacked sufficient power to detect a true effect of fear avoidance. Additional research is needed to improve our understanding of the joint contribution of fear-avoidance beliefs and recovery expectations in affecting injury recovery outcomes.

Our expectation that depression would predict worse recovery was not supported. Although there appears to be a relationship between clinical depression and chronic pain [56, 57], results on depressive symptoms and/or psychological distress as predictors of recovery from musculoskeletal injuries have been mixed [5, 8, 58, 59]. The relationship between depression and musculoskeletal injury recovery is clearly complex, and deserves additional research attention.

Our expectation that optimism would be predictive of better recovery was not confirmed, and even the bivariate association of optimism with recovery was close to zero ($r = .05$, $p > .10$). Although it seems conceptually related to recovery expectations, dispositional optimism is a much broader construct than recovery expectations, encompassing expectations about the future in a variety of different contexts. It may be that optimism is too broad a construct to be useful for predicting injury recovery outcomes. Finally, our expectation that workplace factors (job satisfaction and supervisor support) would be predictive of injury recovery was also not confirmed. Although our results conflict with some research on this topic [25, 26, 28], results on workplace factors have not been consistent [60–62].

In summary, our objective was to examine the predictors of injury recovery that appeared to be the most promising based on past research (recovery expectations, fear-avoidance beliefs, and depression). We also included some additional predictors of injury recovery that appeared promising (optimism, pain-catastrophizing, supervisor support, and job satisfaction). The inclusion of a number of competing predictors that were simultaneously examined within the same study design allowed the relative importance of these variables to be evaluated. Our findings revealed that although recovery expectations was confirmed to be a very important predictor of injury recovery, fear-avoidance beliefs and depression were not found to be unique predictors of recovery, once recovery expectations were taken into account. Similarly, the other potential predictors of recovery (optimism, pain-catastrophizing, supervisor support, and job satisfaction) did not play a significant role in the prediction of injury recovery. Although many studies have examined fear-avoidance beliefs, pain-catastrophizing, and depression, it is possible that these variables are relatively unimportant in comparison to recovery expectations. Future research should seek to confirm this possibility in a larger, more diverse sample.

This study had important limitations that should be noted. First, the response rate for the follow-up portion of the study was only 60 %, which could have potentially biased our findings. Additionally, the small sample size ($N = 134$) may have limited our power to detect some true predictive associations, particularly in the multivariate analysis. The study also did not include an objective measure of the severity of the injury. Another limitation was the reliance of this study on self-reported data, which are subject to social desirability effects and other types of response bias. The present results may not necessarily generalize beyond the military, given the homogeneity of the present sample, who were predominantly young and male, and the military culture that values action and "getting the job done."

The study also had a number of important strengths. Unlike many studies of recovery from musculoskeletal injuries, the participants in this study were fairly homogeneous on a number of characteristics such as employment status (i.e., all were employed), socioeconomic level, education level, and age. Another strength was the prospective study design. An additional strength of the study was the inclusion of a wide variety of psychosocial covariates that previous research has found to be predictive of injury recovery, such as recovery expectations, pain catastrophizing, fear-avoidance beliefs, optimism, and depression.

In conclusion, we found that recovery expectations were a strong predictor of recovery among enlisted active-duty Marines with musculoskeletal injuries. With other key variables controlled, Marines who had high recovery expectations at baseline were over five times as likely to be recovered at follow-up as Marines who had low expectations. The results of this research extend a large body of past research indicating the importance of recovery expectations in relation to recovery and return-to-work outcomes. These findings suggest that it may be productive to test brief interventions specifically designed to modify musculoskeletal injury patients' expectations about recovery and their ability to return to work.

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Conflict of interest The authors declare that they have no conflict of interest.

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14. ABSTRACT
Purpose Research suggests the importance of psychosocial factors in recovery from musculoskeletal injuries. The objective of this study was to identify predictors of recovery among U.S. Marines who had musculoskeletal injuries of the back, knee, or shoulder.

Methods A sample of 134 participants was assessed at baseline and followed for 1 year to determine outcome information.

Results The strongest predictor of injury recovery at the 1-year follow-up was recovery expectations. In a multivariate logistic model with key demographic and psychosocial factors controlled, individuals who had high recovery expectations at baseline were over five times as likely to be recovered at follow-up as individuals who had low expectations (OR = 5.18, *p* \.01).

Conclusions This finding is consistent with a large body of research that has linked recovery expectations with better recovery outcomes in patients with musculoskeletal injuries as well as with research linking recovery expectations with better outcomes across a wide range of medical conditions. Applied to military populations, interventions designed to modify recovery expectations may have the potential to improve rates of return to duty and to reduce rates of dis- ability discharge.

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